

# RESEPT

## PATENT SPECIFICATION

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### COMPLETE SPECIFICATION

#### Improvements in or relating to dry-rectifiers with liquid cooling arrangements

We, SIEMENS-SCHUCKERTWERKE AKTIENGESELLSCHAFT, a German Company, of Berlin and Werner-von-Siemens Strasse, 13a Erlangen, Germany, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to a dry rectifier with a liquid cooling arrangement.

An arrangement has already been proposed for the cooling of dry rectifiers in which the same liquid coolant passes successively through cooling means of a number of rectifier elements or rectifier parts which are at different electrical potentials during operation. In order to separate electrically the cooling means of the various rectifier elements or rectifier parts from one another, it has been proposed, in cases where the cooling means for the different elements or parts are connected in series to form a path for the coolant, to provide intermediate conduits consisting of insulating material between the individual cooling means. When the successive rectifier elements or rectifier parts are electrically separated, or insulated from one another by the body of the coolant conduits, no effective electrical separation between the cooling means, the dry rectifier elements or the dry rectifier parts can be ensured if water is employed as a coolant, by reason of the conductivity of the water. The potential difference appearing on the coolant column between each pair of cooling means results in corrosion phenomena which occur in the coolant system, and shorten the useful life of the latter.

It is an object of the present invention to eliminate this inconvenience.

According to the present invention there is provided a dry rectifier, wherein a plurality of rectifier elements and a plurality of cooling means are provided, each cooling means being associated with at least one rectifier element and being intended to operate whilst at a differ-

ent electrical potential from the other cooling means, each cooling means having a duct with an inlet and an outlet for the passage of a liquid coolant supplied by conduits, the conduits being connected to the inlets and outlets so that the coolant can pass in succession through the cooling means, the conduits being made of an electrically insulating material, and wherein the inner surface of at least the inlets and outlets, and optionally, all the inner surface of each duct and of each conduit, adjacent the liquid coolant is provided with an electrolytic corrosion resistant lining or is made of an electrolytic corrosion resistant material.

The points particularly exposed to corrosion are the inlets and outlets of the ducts of the various cooling means so that at least these inlets and outlets are made corrosion proof by being, e.g., provided with a corrosion proof coating or layer to form a lining which is resistant to electrolytic corrosion or by being made of a corrosion-proof material, such, as a precious metal. Preferably there can be used as an anti-corrosive layer a layer of lacquer or a layer of precious metal, it being possible to apply the latter, for example, by cladding or by electro-plating.

A further means which can be employed, for the corrosion-proof lining of the coolant ducts is to insert a flexible pipe of corrosion proof material into the ducts. The flexible pipe can be made very thin, since the duct in which it is disposed serves as a mechanical support therefor. The pipe can also be produced from such material that it is sufficiently effective as an electrical insulator. Due to the small wall thickness which may be used in the flexible pipe, the latter provides a short path for heat transference between the cooling liquid in the flexible pipe and the wall of the cooling duct which surrounds the pipe. The heat transference can be made more favourable by using for the flexible pipe material having relatively good thermal conductivity. The flexible pipe can extend either between the inlet and outlet

(Price 3s.)

Price 3s.

Price 4s. 6d.

connections of one cooling means or through a plurality of consecutive cooling means in the coolant duct of each cooling means, and through the conduits between them.

- 5 The cooling duct in which the flexible pipe is disposed can also be of such cross-sectional form that the inserted flexible pipe can have such an internal cross-section that the ratio between the internal cross-section of the pipe and the periphery of this cross-section is small. A large pipe surface is thus obtained so that a good duct transfer from the cooling means to the coolant can be effected.

- 10 For a better understanding of the invention and to show how the same may be carried into effect, reference will now be made to the accompanying drawings in which:—

Figs. 1 and 2 show sections of one cooling means with associated rectifier elements, Fig. 2 being a complete section on the line II-II shown in Fig. 1, and

Figs. 3 and 4 show sections of part of a second cooling means without any associated rectifier elements, Fig. 4 being a complete section on the line IV-IV shown in Fig. 3.

- Referring now to the drawings, in figures 1 and 2, 1 designates the lower portion of a cooling means and 2 a cover thereof which can, if desired, be held in position with the interposition of a seal, such a cooling means forming one of a succession of cooling means. The two parts together form a sinuously extending cooling duct 3 in the interior of the cooling means, the cooling duct terminating in the inlets and outlets 4 and 5 for connection to coolant conduits. The cooling duct is lined with a corrosion-proof protective coating 6. On each of two surfaces of the cooling means there is disposed one rectifier element 7, 8, the two elements being intended to be cooled by the cooling means, for example during the process of their electrical forming or while in operation. The electrical connecting leads are shown at 9.

- 45 In many cases it will be sufficient to provide only those parts of the coolant ducts in the cooling means near the inlets and outlets with a lining for protection against electrolytic corrosion phenomena.

- 50 In Figures 3 and 4, 1 and 2 again designate the lower and upper parts respectively of a cooling means the rectifier elements being omitted in this case for simplicity, such elements being, however, disposed as in Figs. 1 and 2. In this case there is inserted into the

sinuous duct of the cooling means a flexible pipe 10 consisting of an electrically insulating material of the highest possible thermal conductivity, the wall thickness thereof being as small as possible in order to attain a good heat transfer from the cooling means to the coolant flowing through the flexible pipe. 11 designates the connection of a coolant conduit. The figure also shows how the same flexible pipe can be inserted directly and continuously into the ducts of a plurality of cooling means, thus forming a continuous lining for the ducts of all the cooling means, for example, in a second cooling means 12, a section of which is shown to the right of the first cooling means.

What we claim is:—

1. A dry rectifier, wherein a plurality of rectifier elements and a plurality of cooling means are provided, each cooling means being associated with at least one rectifier element and being intended to operate whilst at a different electrical potential from the other cooling means, each cooling means having a duct with an inlet and an outlet for the passage of a liquid coolant supplied by conduits, the conduits being connected to the inlets and outlets so that the coolant can pass in succession through the cooling means, the conduits being made of an electrically insulating material, and wherein the inner surface of at least the inlets and outlets, and optionally, all the inner surface of each duct and of each conduit, adjacent the liquid coolant is provided with an electrolytic corrosion-resistant lining or is made of an electrolytic corrosion-resistant material.

2. A rectifier as claimed in claim 1, wherein said lining comprises a coating of precious metal.

3. A rectifier as claimed in claim 1, wherein said lining comprises a layer of lacquer.

4. A rectifier as claimed in claim 1, wherein flexible piping is employed as a lining for each duct, the piping being of electrically insulating material.

5. A rectifier as claimed in claim 4, wherein the same flexible pipe forms the lining of at least two of the ducts and the lining of the conduit between them.

6. A dry rectifier, substantially as hereinbefore described with reference to the accompanying drawings.

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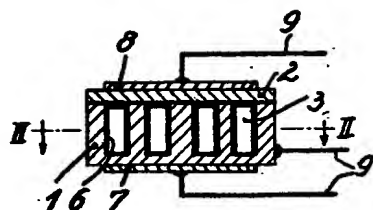


Fig. 1

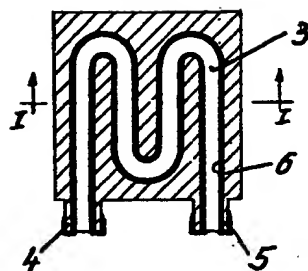


Fig. 2

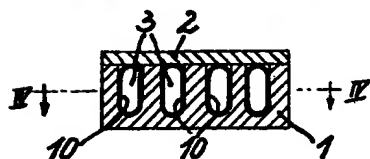


Fig. 3

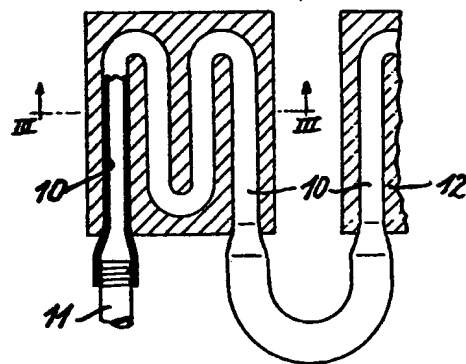


Fig. 4